**Claims**

1. A device for coupling RF energy from a transmission line to a plurality of couplers comprising:

at least one transmission line for carrying energy from a radio frequency (RF) source;

a plurality of interconnecting upper plates distributed above the transmission line whose dimension extends laterally beyond the width of the transmission line;

a plurality of interconnecting lower plates distributed below the transmission line whose dimension extends laterally beyond the width of the transmission line;

a plurality of vias positioned to sequentially connect an end of individual upper plates to individual lower plates so as to form a helix structure centered around the transmission line;

a plurality of secondary plates embedded into the helix structure which are parallel to the transmission line;

at least one capacitive element electrically connected to one end of aforementioned helix structure;

at least one resistive element electrically connected to an opposite end of the helix structure from the at least one capacitive element; and

a ground layer positioned below the plurality of interconnecting lower plates and above the plurality of interconnecting upper plates.

2. A device as in claim 1, wherein the at least one transmission line, at least one forward coupler, and at least one reverse coupler are a microstrip.

3. A device as in claim 1, wherein the at least one transmission line, at least one forward coupler, and at least one reverse coupler are a stripline.

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4. A multi-element directional coupler used with a multi-layer printed circuit board comprising:

a first coupling structure connected to a radio frequency source;

a plurality of second coupling structures positioned above the first coupling structure for coupling radio frequency (RF) energy;

a plurality of third coupling structures positioned below the first coupling structure for coupling RF energy;

a plurality of vias for connecting individual segments of the plurality of second coupling structures with individual segments of the plurality of third coupling structures so as to form a helix structure with axis of rotation centered around the first coupling structure;

a plurality of secondary plates embedded into the plurality of second coupling structures;

a plurality of secondary plates embedded into the plurality of third coupling structures;

a ground layer positioned above the plurality of second coupling structures for providing isolation; and

a ground layer positioned below the plurality of third coupling for providing isolation.

5. A multi-element directional coupler according to claim 4, wherein the first coupling structure is a RF transmission line.

6. A multi-element directional coupler according to claim 5, wherein the RF transmission line is a stripline.

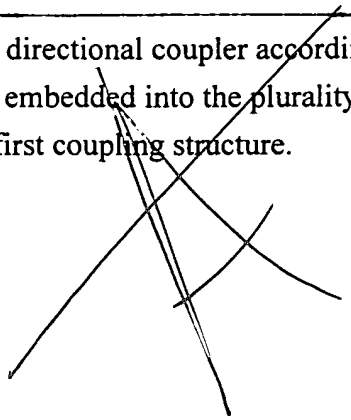
7. A multi-element directional coupler according claim 5, wherein the RF transmission line is a microstrip.

8. A multi-element directional coupler according to claim 4, wherein the helix structure is a forward power coupler.

9. A multi-element directional coupler according to claim 8. wherein the helix structure is an reverse power coupler.

10. A multi-element directional coupler according to claim 4, wherein the plurality of secondary plates embedded into the plurality of second coupling structures are positioned parallel with the first coupling structure.

11. A multi-element directional coupler according to claim 4, wherein the plurality of secondary plates embedded into the plurality of third coupling structures is positioned parallel with the first coupling structure.



12. A radio frequency (RF) power coupling device comprising:

at least one transmission line for conducting RF energy;

a first plurality of upper connecting structures positioned above the at least on transmission line for providing connectivity for coupled RF energy traveling on the at least one transmission line;

a second plurality of lower connecting structures positioned below the at least on transmission line for providing connectivity for coupled RF energy traveling on the at least one transmission line;

a plurality of vias for connecting individual segments of the first plurality of upper connecting structures with individual segments of the second plurality of lower connecting structures so as to from a helix geometric structure;

a first ground layer positioned above the plurality of upper connecting structures for isolating the at least one transmission line and the plurality of upper connecting structures; and

a second ground layer positioned below the plurality of lower connecting structures for isolating the at least one transmission line and the plurality of lower connecting structures: and

wherein at least one of via of the plurality of vias is positioned a predetermined distance from the transmission line for increasing coupling between the at least one transmission line and the helix structure;

13. A radio frequency power coupling device as in claim 12, wherein the at least one transmission line, first plurality of upper connecting structures and second plurality of lower connecting structures are planar structures.

14. A radio frequency power coupling device as in claim 12, wherein the at least one transmission line is a microstrip, first plurality of upper connecting structures are air bridges and second plurality of lower connecting structures are strip line.

15. A radio frequency power coupling device as in claim 12, wherein the at least one transmission line, first plurality of upper connecting structures and second plurality of lower connecting structures are a stripline.

16. A radio frequency power coupling device as in claim 12, further comprising:

at least one secondary structure embedded into the plurality of upper connecting structures each positioned a predetermined distance from the at least one transmission line, for increasing coupling between the at least one transmission line and helix geometric structure.

17. A radio frequency power coupling device as in claim 12, further comprising:

at least one secondary structure is embedded into the plurality of lower connecting structures, each positioned a predetermined distance from the at least one transmission line, for increasing coupling between the at least one transmission line and helix geometric structure ;

18. A radio frequency power coupling device as in claim 17, further comprising:

at least one secondary structure is embedded into the plurality of lower connecting structures, each positioned a predetermined distance from to the at least one transmission line, for increasing coupling between the at least one transmission line and helix geometric structure.

19. A radio frequency power coupling device as in claims 16, 17 or 18 wherein the at least plurality of upper connecting structures and plurality of lower connecting structures are planar.

20. A radio frequency power coupling device as in claim 16, 17 or 18 wherein the secondary structure which is embedded into the plurality of connecting structures is parallel with the at least one transmission line, for increasing coupling between the at least one transmission line and helix geometric structure

21. A radio frequency power coupling device as in claim 16, 17, or 18 wherein the at least one transmission line is positioned on a first substrate.

22. A radio frequency power coupling device as in claim 20, wherein the plurality of upper connecting structures is positioned on a second substrate.

23. A radio frequency power coupling device as in claim 21, wherein the plurality of plurality connecting structures is positioned on a third substrate.

24. A radio frequency power coupling device as in claim 22, wherein the second substrate and the third substrate are asymmetrically positioned a predetermined distance from the first substrate.

25. A method of increasing the coupling coefficient of a directional coupler device which includes at least one transmission line and at least one magnetic field coupling device comprising the steps of:

positioning an upper interconnecting structure in a second plane parallel to and above plane with the transmission line;

positioning a lower interconnecting structure in a third plane parallel to and below plane with the transmission line;

aligning at least one magnetic field coupling structure at a predetermined distance from and parallel to the at least one transmission line;

electrically interconnecting the at least one magnetic field coupling device with the upper or lower interconnecting structure; and

electrically interconnecting the upper and lower interconnecting structure using at least one via.

26. A method as in claim 25, wherein the at least one magnetic field coupling device is a forward power coupler.

27. A method as in claim 25, wherein the at least magnetic field coupling device is a reverse power coupler.

28. A method as in claim 25, wherein the at least one transmission line is a microstrip, upper interconnecting structures are air bridges and second plurality of lower interconnecting structures are strip line.

29. A method as in claim 25, wherein the at least one transmission line, upper interconnecting structures and lower interconnecting structures are a stripline.

30. A radio frequency (RF) power coupling device comprising:

at least one transmission line for conducting RF energy;

a helix structure with a plurality of windings positioned such that the transmission line is located along the helix structure axis of rotation; and

a plurality secondary structures connected to the helix structure and positioned parallel to the at least one transmission line at predetermined distances from transmission line.

31. A radio frequency power coupling device as in claim 31, wherein the plurality of secondary structures are of variable length.